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BIOLOGY OF APHODIINAE WITH SPECIAL REFERENCE TO OREGON

(Coleoptera: Scarabaeidae)

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Our knowledge of the biology of the subfamily Aphodiinae is still rather fragmentary. Such information as is now available relates only to a few of the known species (Mulsant, 1842, 1871; Xambeau, 1890; Cabanes, 1920; Madle, 1934; Hoffman, 1935; Martyn, 1956; Ritcher, 1958).

TRIBE AEGIALIINI

Species belonging to this tribe have been described since 1787, but so far no one has reported on the biology of the group. We have collected several species under vegetation on sand dunes at the Oregon coastal beaches and also in sandy areas along inland streams.

At Waldport, Oregon, *Aegialia blanchardi* Horn was collected throughout the year from 1955 to 1957, inclusive. This species was collected by sifting sand around and beneath the roots of vegetation on the dunes. Apparently there is only one generation a year because larvae and pupae were found only during early summer from May 29 to July 16. Usually they were at a depth of approximately 6 to 8 inches below the surface. At this depth, the temperature ranges from 50° to 60° F. throughout the year. Adults were present throughout the year just below the surface.

Temperature seems to have some effect on the length of the pupal stage within the range of 60° F. to approximately 70° F.; it has considerable effect on mortality. On June 12, 1956, more than 200 third-stage larvae of *Aegialia blanchardi* Horn were collected at Waldport, Oregon. One group of 20 larvae, each in a separate salve box, was kept at room temperature. These larvae pupated in two to four days and the pupal stage lasted for 12 to 15 days, but the mortality was 60%. Another group of 20 larvae, each in a separate salve box, was kept at 60° F. These larvae pupated seven to 10 days later and the

pupal stage lasted for 15 to 19 days. The mortality in this group was only 10%.

At Kiger Island, five miles southeast of Corvallis, Oregon, on May 27, 1957, numerous second and third-stage larvae and adults of *Aegialia* spp. were collected in sand drifts under willows, by sifting the sand. (Dr. O. L. Cartwright of the U.S. National Museum identified the adults as *Aegialia blanchardi* Horn, *A. lacustris* LeConte, *A. latispina* LeConte, and *A. nigrella* Brown). Eight trips were made from May 27, 1957 to September 15, 1957, but no larvae were found on either August 15 or September 15, 1957. Pupae were found as early as June 17, and as late as August 15, 1957. Examination of the fore gut contents showed that the larvae were feeding only on decaying organic matter.

The above information indicates that the species of the genus *Aegialia* apparently have one generation a year and the adults over-winter. The adults probably lay eggs in spring, and the larval stage lasts till the third week of July. Newly transformed adults were numerous during late July and August. Examination of the ovaries of the females during August and September showed no egg development.

TRIBE APHODIINI

Food Habits and Economic Importance: The members of this tribe are commonly found in dung all over the world. Species have been reported to occur in deer, cow, horse, sheep, human, elephant, rat, and other animal manure. Eight species, however, have been found to feed on live roots of plants. Four are parasitic and one feeds on decaying leaves. Two species seem to be myrmecophiles.

Lugger (1899) observed larvae of *Aphodius granarius* (Linnaeus) eating the sprouting seeds of corn in Minnesota. In Oregon, larvae of *A. granarius* have been found in the soil where they may have been feeding on grass roots. Downes (1928) in British Columbia and Ritcher and Morrison (1955) in Oregon, reported larvae of *Aphodius pardalis* LeConte feeding on golf turf and doing considerable damage.

Swan (1934) and Carne (1950) recorded *Aphodius howitti* Hope (= *A. tasmaniae* Hope) destructive to pastures in the southeast portion of Australia and Tasmania. Van Emden (1941) records larvae of *Aphodius fimetarius* (Linnaeus) being noxious on potatoes at Bremen, Germany, and larvae of *Aphodius contam-*

inatus Herbst were collected in a golf course. In England, adults of *A. fimetarius* and *Aphodius subterraneus* (Linnaeus), which are common in horse manure, have been reported to injure mushrooms by devouring portions of the caps (Anonymous, 1944).

Martyn (1956), in Tasmania, worked out the distribution in relation to climate of *Aphodius howitti* Hope and *Aphodius pseudotasmaniae* Given. According to him, the larvae of these species feed on pasture plants.

Aphodius larvae were collected injuring mint roots at Quincy, Washington, on July 27, 1955 by C. H. Starker. Adults reared from these larvae were identified by O. L. Cartwright as *Aphodius distinctus* Müller. Larvae later identified as *Aphodius hamatus* Say were found injuring the turf in pastures in Ruby Valley, Nevada, by R. W. Lauderdale.

Chapman (1870) noted *Aphodius porcus* (Fabricius) parasitizing the egg of *Geotrupes stercorarius* (Linnaeus). Howden (1955) found *Aphodius lividus* (Olivier) and *Aphodius rubeolus* Beauvois parasitizing and developing in the egg cell of *Phanaeus* and *Onthophagus medorensis* Brown. Howden is of the opinion that *Aphodius* larvae destroy and may consume the eggs or larvae of the host.

Larvae of *Aphodius* sp. were collected in a *Formica* nest at a locality eight miles east of Silver Lake, Oregon, on May 16, 1957. These larvae were found in the dry upper part of the nest, with the ants, but were not being bothered by the ants. Mann (1911) collected eight adults of *Aphodius suspectus* Mann, on bait, from a *Formica* nest at Pullman, Washington.

Adults of *Oxyomus silvestris* (Scopoli) have been recorded to occur in dung in Europe, Schmidt (1911). Larvae loaned to the writers by the U.S. National Museum were collected in the soil around roses at Luxemburg on May 24, 1949.

Length of Life Cycle: According to Madle (1934), *Aphodius fimetarius* (Linnaeus) and *Aphodius depressus* Kugel have two generations a year and *Aphodius fossor* (Linnaeus) and *Aphodius rufipes* (Linnaeus) have a single generation a year in Dresden (Germany). There, *A. fimetarius* and *A. depressus* overwinter as larvae, whereas *A. fossor* and *A. rufipes* may overwinter as larvae which pupate in spring. *A. rufipes* and *A. fossor* may overwinter as adults, if the conditions are favorable in early fall. Also, in Germany, *Aphodius alpinus* (Scopoli) over-

winters as larvae and *Aphodius prodromus* Brahm overwinters as adults.

Most members of this tribe, in Oregon, have one generation a year. According to the writers' observations, *Aphodius fimetarius* (Linnaeus), *Aphodius granarius* (Linnaeus), *Aphodius pectoralis* LeConte, *Aphodius sparsus* LeConte, and *Aphodius aleutus* (Eschscholtz) have one generation a year. *Aphodius vittatus* Say appears to have two generations a year in Oregon. *A. fimetarius*, *A. granarius* and *A. vittatus* overwinter as adults, whereas *A. sparsus* and *A. aleutus* overwinter as mature larvae.

According to van Emden (1941), the larvae of lamellicornia moult thrice, the third ecdysis releasing the pupa. The writers have also found only three instars of *Aphodius* larvae.

TRIBE EUPARIINI

Of the tribe Eupariini, biological information is available only for *Ataenius cognatus* (LeConte), Hoffman (1935). Brief notes on the habitats for some members of this tribe are given by Cartwright (1944, 1948, and 1952) in his papers on adults.

Hoffman (1935) states that the larvae of *Ataenius cognatus* (LeConte)¹ infest golf courses in Minnesota. The adults in Minnesota overwintered, and there was one generation a year. According to him, the beetles were taken in light traps as early as May 1, but the females oviposited in late May or June. The length of pupal period in the laboratory was 8.7 days. On September 1, on digging in the golf course, no larval stages were found, but the beetles were hiding in waste piles of grass.

Adults and larvae of *Ataenius spretulus* (Haldeman) were collected and reared in cow dung by Paul O. Ritcher at Lexington, Kentucky during 1944.

Adults of *Ataenius saxatilis* Cartwright were collected in South Carolina in sand washed down to the edges of pockets or islands of soil and vegetation on outcroppings of bare weathered areas of granite or rocks, or in the sand or soil around the lower edges or such areas of rock (Cartwright, 1944).

Adults of *Ataenius fattigi* Cartwright were collected in South Carolina under leaves, twigs and surface litter along paths on hard ground in woodlands. Two adults were taken under dry

¹ According to O. L. Cartwright in a letter dated September 22, 1955, the species with which Hoffman was dealing could be *Ataenius spretulus* (Haldeman).

cow dung in a burned-over woods and a few more taken in light traps (Cartwright, 1948).

Adults and larvae of *Euparia castanea* Serville are recorded occurring in ant nests (Schmidt, 1911). According to Horn (1887), this species occurs in Florida, Alabama and Louisiana in the nests of a small ant (species not given).

Adults and larvae of *Saprosites* are found under the bark of trees (personal communication from O. L. Cartwright). Adults and larvae of *Aphotaenius* are common in cow and deer droppings in North Carolina from April 29 to September 10 (Cartwright, 1952).

TRIBE PSAMMODIINI

In Oregon, adults and larvae of *Psammodius* spp. have only been collected at the coastal dunes, under vegetation. In other parts of the United States, species of *Psammodius* have been collected along inland streams (Cartwright, 1955).

Adults and larvae of *Psammodius oregonensis* Cartwright were found throughout the year, at Waldport, Oregon, under vegetation. Larvae were found in the sand, six to eight inches below the surface, where the temperature ranged from 55-60° F. Adults were found just beneath the surface. Examination of the fore-gut contents of the larvae showed live plant tissue, indicating they feed on the roots of vegetation. Pupae and numerous newly transformed adults were collected during August and September.

On September 5, 1957, a trip was made to sample the coastal area from Oceanlake northwards to a point eight miles south of Astoria, Oregon. A great many adults and larvae (second and third-stage) were collected at numerous points along this area. They were common at a distance of about half a mile away from the ocean.

Adults of *P. oregonensis* from Waldport, Oregon, did not lay eggs in captivity even though eggs were in the ovaries. The length of pupal stage at room temperature was found to be from 10 to 12 days, but the mortality was very high. At 60° F. third-stage larvae pupated in 60 to 80 days after they were brought from the coast with the pupal stage lasting for 10 to 15 days. The mortality at 60° F. was about 8%.

Adults and larvae of *Pleurophorus* have been recorded occurring in soil or in dung (Mulsant, 1842). Larvae of *Pleurophorus caesus* (Creutzer) were collected in soil around roots of *Zinnia*

plants by J. B. Steinweden and P. C. Ting in an evergreen nursery at San Francisco, California, on June 11, 1934. Adults emerged on June 30, 1934.

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HESPEROCIMEX COLORADENSIS LIST IN OREGON

(Hemiptera: Cimicidae)

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The junior author collected a series of *Hesperocimex coloradensis* List from an abandoned woodpecker nest at Prairie City, Grant County, Oregon, on April 25, 1959. This nest was in a fallen poplar tree and would have been approximately 25 feet

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